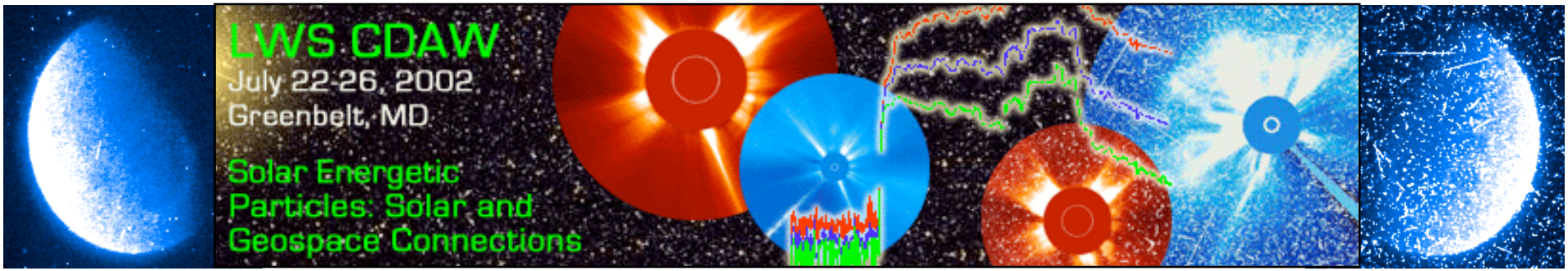
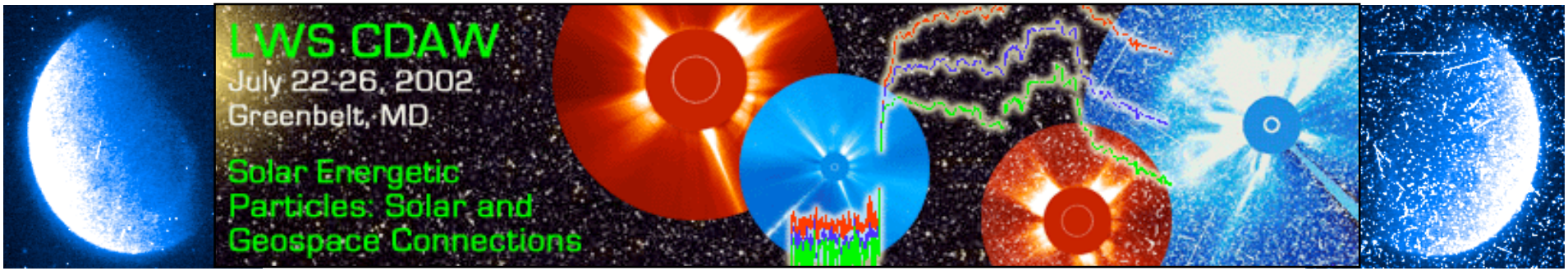


WGIII: Geospace Impact

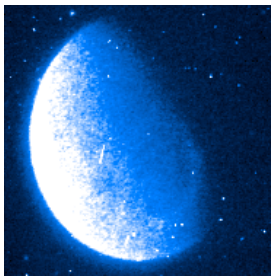
BARTH, Janet L.
XAPSOS, Michael
HUDSON, Mary K.
MAZUR, Joseph E.
DeLAND, Matthew
HAINES, Paul
SLOCUM, Penny
TURNER, Ron
GILES, Barbara
TYLKA, Allan J.
Kirsten Lorentzen



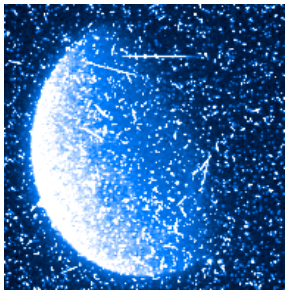
WGIII: Geospace Impact

Science questions:

1. What is the relationship between SEPs and the energetic particles in the magnetosphere?
2. How is SEP access to the inner magnetosphere determined during the transient phase?
3. How are SEPs trapped and subsequently lost in the inner magnetosphere?
4. What correlations are there between definable SEP parameters and corresponding effects on the atmosphere and is there a predictive capability?
5. What correlations are there between definable SEP parameters and corresponding effects on technological systems/human flight?



WGIII: Plan of Attack



Focus on the Interfaces:

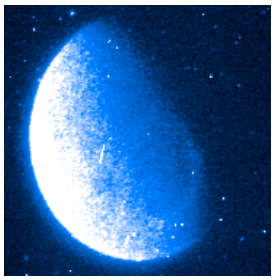
- Keep in mind the cross-disciplinary aspect of LWS, define and then provide those data products necessary for progress on “coupling” studies.

Statistical Studies:

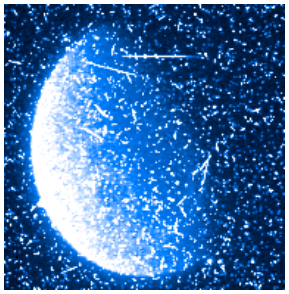
- Define set of parameters that uniquely characterize SEP events and are relevant for geospace/atmospheric/technology responses.
- Quantify relationships between these SEP parameters and the geospace/atmospheric/technology responses.

Event Studies:

- Compare observed proton energy spectra to trapped proton models.
- Understand injection of SEP ions at low L-shells.
- Understand variability of SEP access in the polar caps



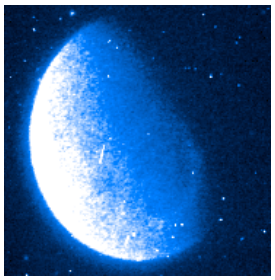
WGIII: CDAW Progress



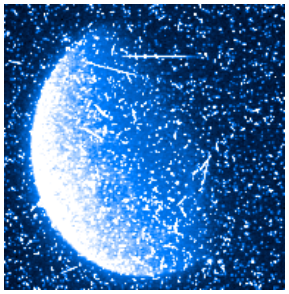
Provide data products and theory for the improvement of space weather models.

Provide data products for technology related event/anomaly databases.

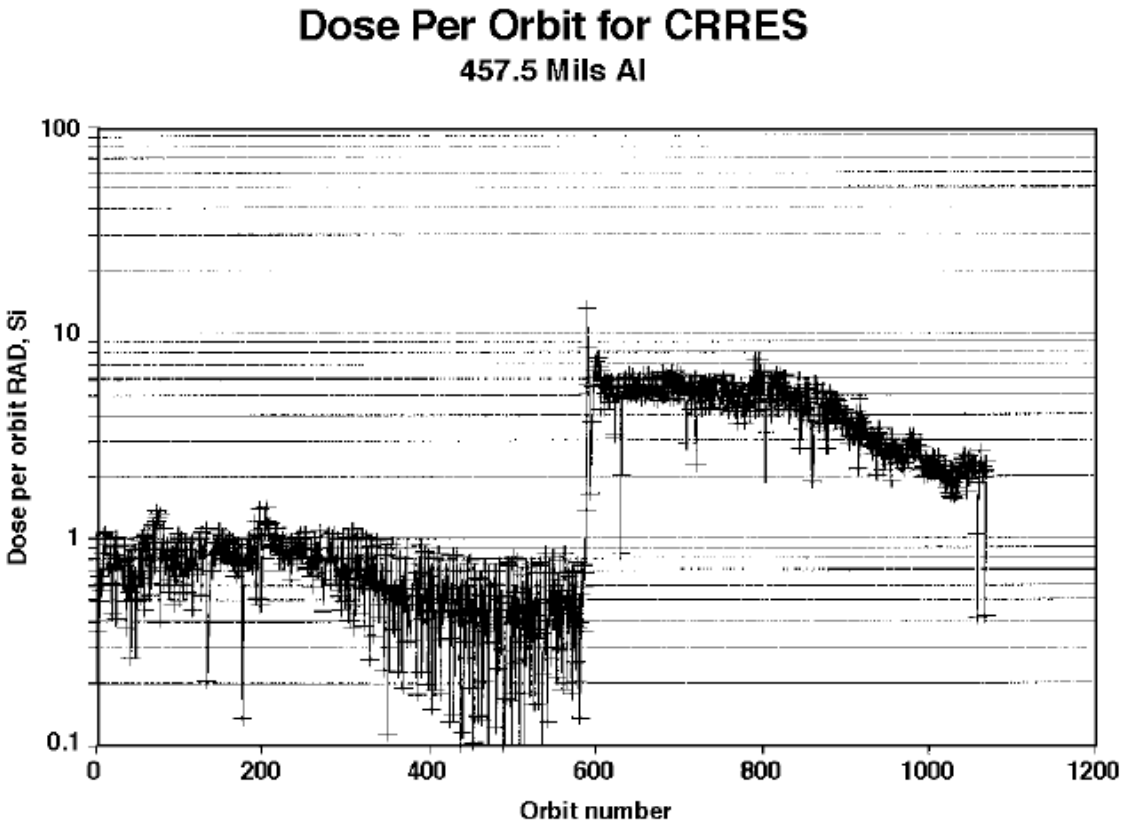
- NOAA predict models: improved physical methodology/understandings.
- Composition/energy spectra as a function of time. Particularly for high energies.
- Worst case estimations w/ confidence levels, particularly high energies (>100MeV). For 11 CDAW events, why event progressed as it did … could we have predicted, with what confidence … how much worse could it have gotten.
- Better understanding of dynamics at geosynchronous orbit, for CDAW events.
- Validation of trapped particle models for MEO, for 12 CDAW events provide application data, perhaps perform validation with a few.
- Long term variation of “slot region” filing, for CDAW events.
- Duration of slot region populations, for CDAW events
- Dynamic solar particle cutoff latitudes, for CDAW events
- Contributions to anomaly/standard event archives - data, data, data.
- Prediction of “all clear”, speculations based on CDAW events.



WGIII: CDAW Progress

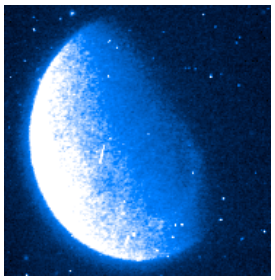


The dose behind heavy shielding increased a factor of 10 on 24 March 1991.

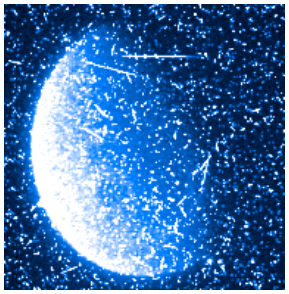


2817-95 B13

(The Aerospace Corp.)



WGIII: CDAW Progress

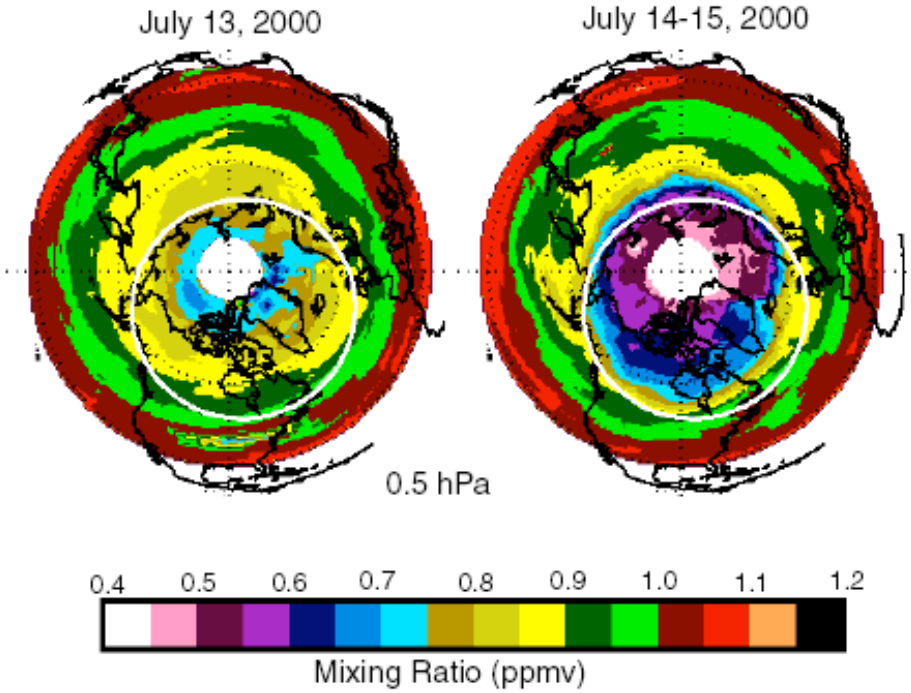


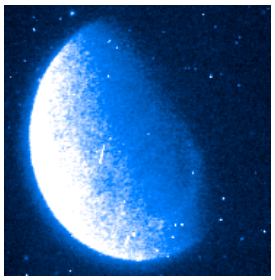
Provide data products for progress toward understanding ozone and odd nitrogen depletions in the atmosphere.

Known:

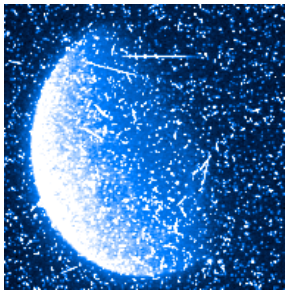
• Increased production of HOx (H, OH, HO2) species and NOx species (N, NO, NO2). Factor of 2-5, lasting up to weeks.

NOAA 14 SBUV/2 Northern Hemisphere polar ozone in ppmv before (July 13, 2000) and during (July 14/15) the SPE period at 0.5 hPa. From Jackman et al., GRL, 2001.



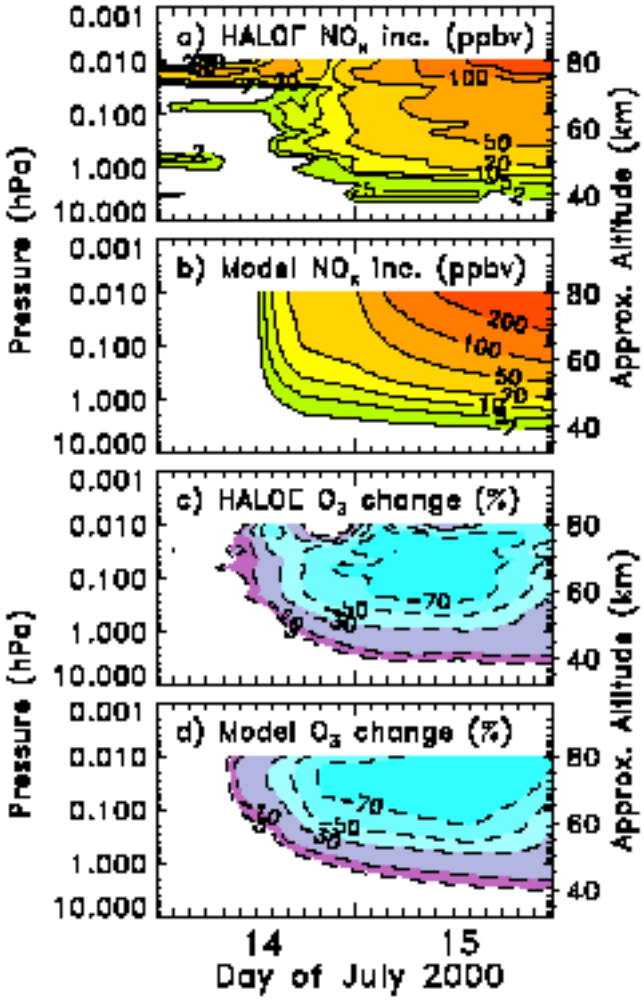


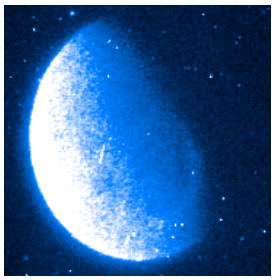
WGIII: CDAW Progress



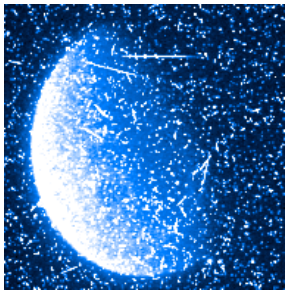
Currently, working toward identifying the important input parameters:

Maximum flux: What proton energy is best indicator?
Peak flux vs fluence: Which is more important?
Time evolution: More impact with fast rise time?
Spectral shape: Dependence on 10 MeV/100 MeV ratio?
Location on Sun: Leading edge vs trailing edge?
Cutoff latitude: Natural deviations from the 60° MLAT used in the models important?
Seasonal variation: Difference in input to polar cap?
Orientation of IMF?
Geomagnetic storms important?



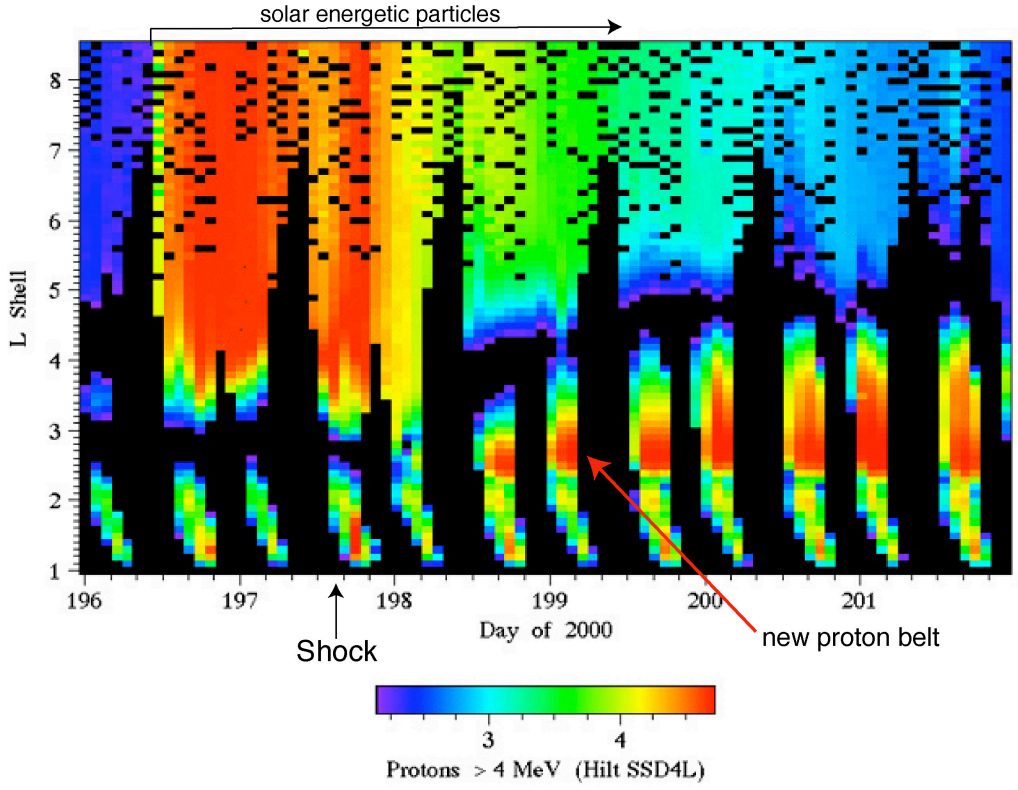


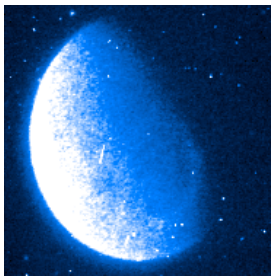
WGIII: CDAW Progress



Make the connection between solar dynamic conditions and the formation of new ion belts at low L-shells. When are conditions right?

Make substantial progress toward understanding the physical processes behind the formation of new ion radiation belts.





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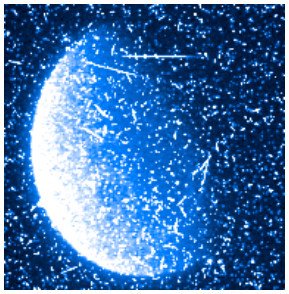
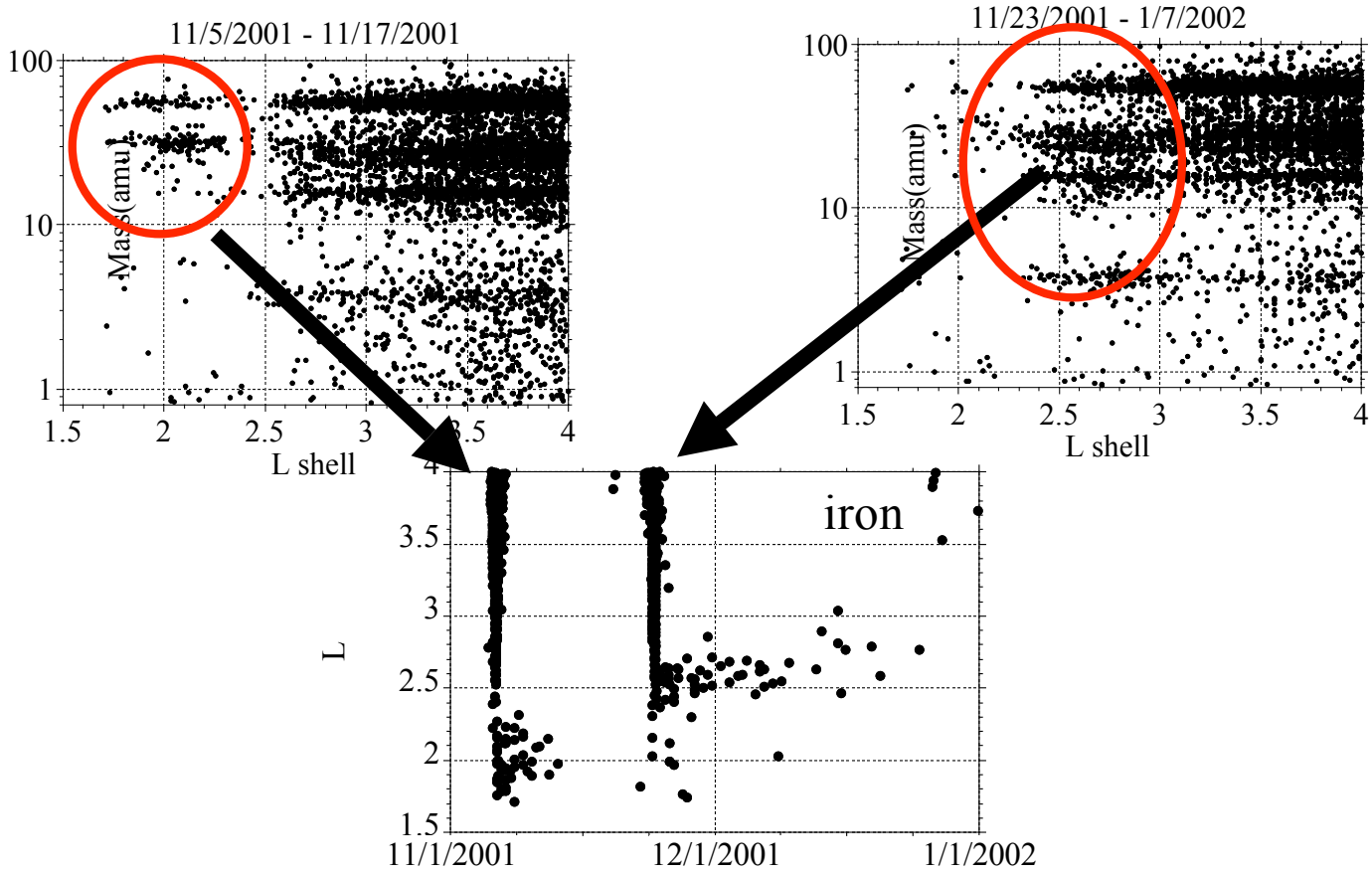
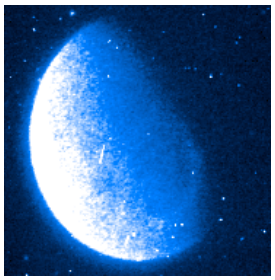


Do not yet understand differences in trapped particle composition or location





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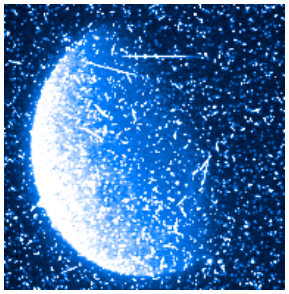
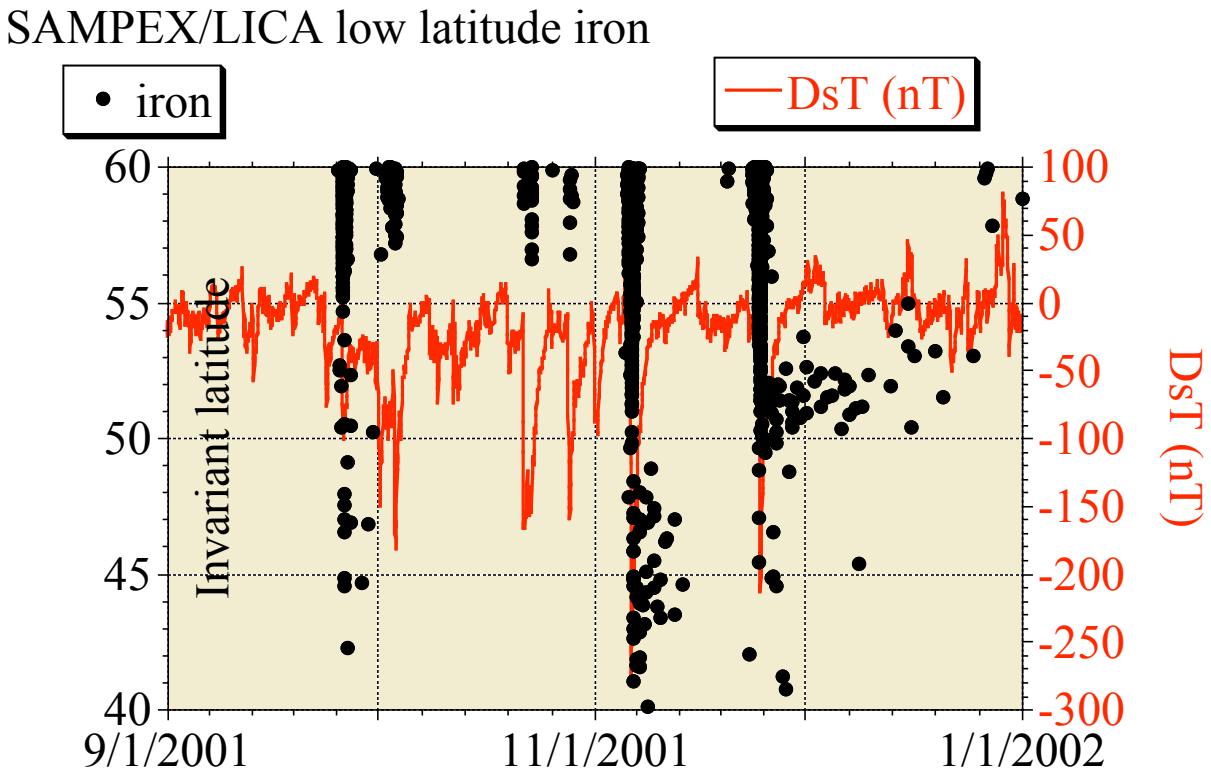
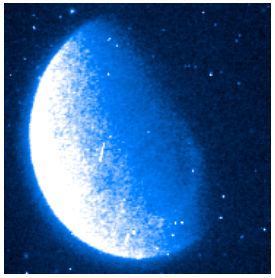
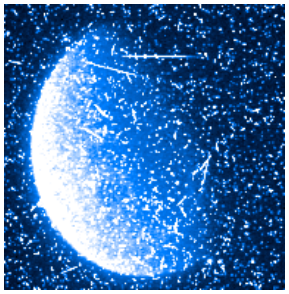


Do not yet understand variation in the penetration depth for trapped SEP particles.

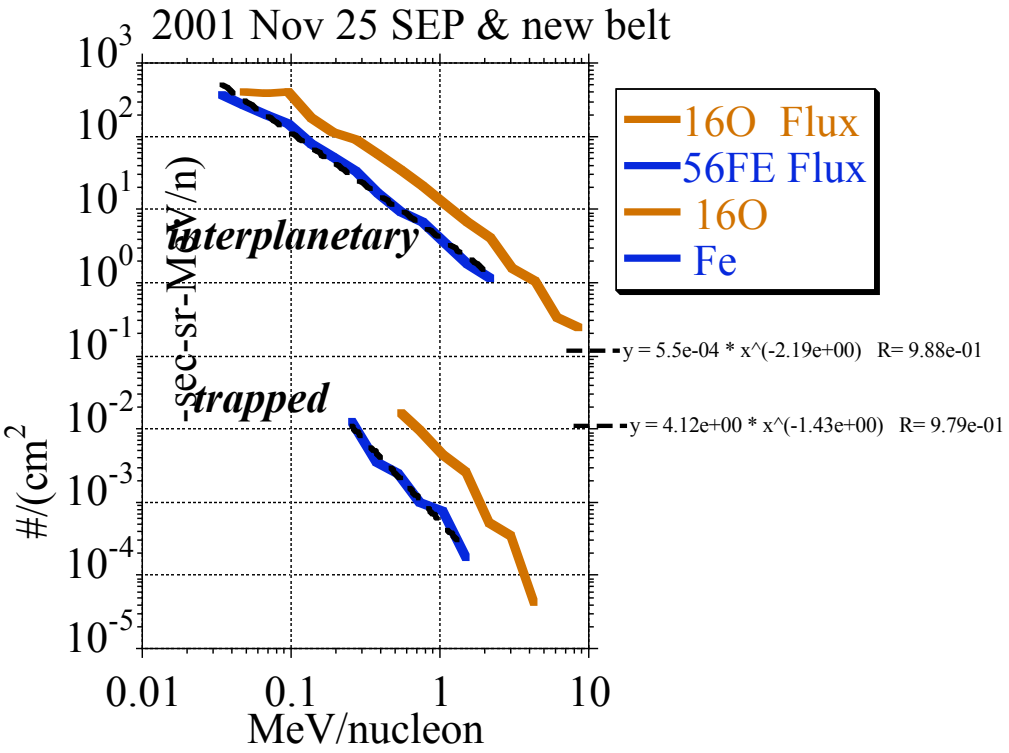


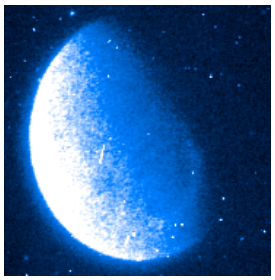


WGIII: CDAW Progress



- Have not explored maximum energies obtained
- Requires tailored MHD simulations of each geomagnetic storm





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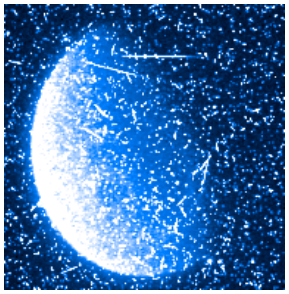
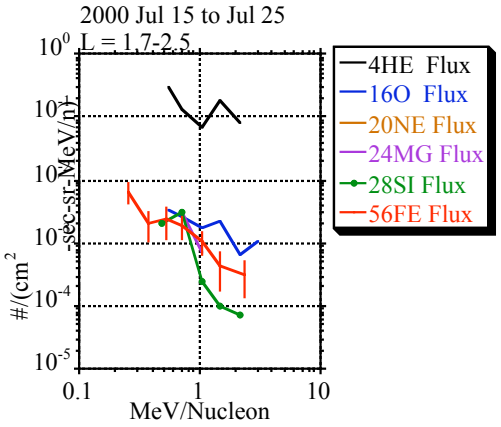
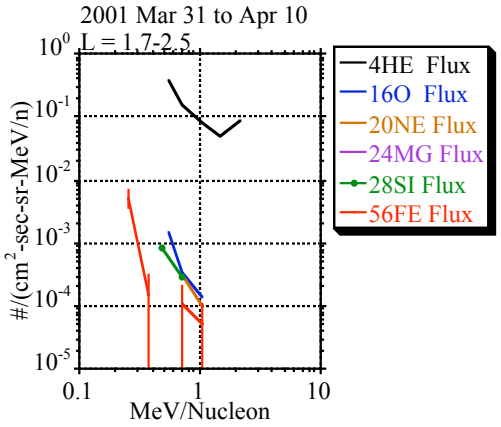
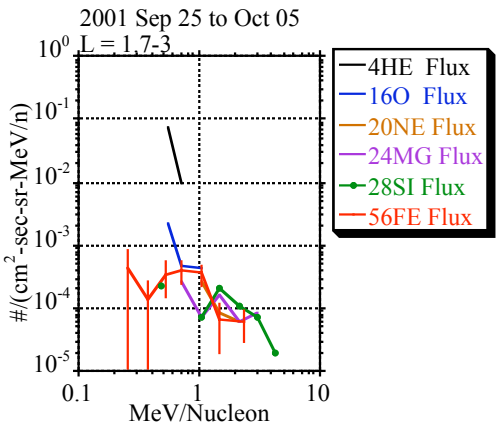
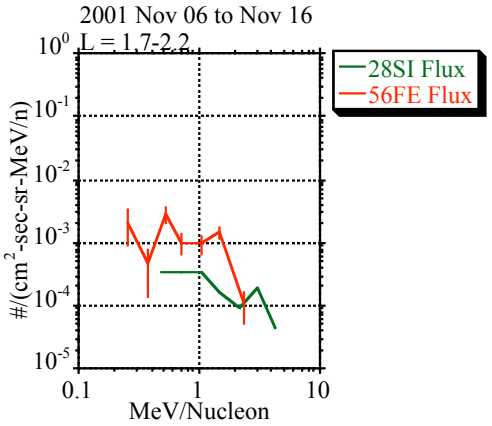


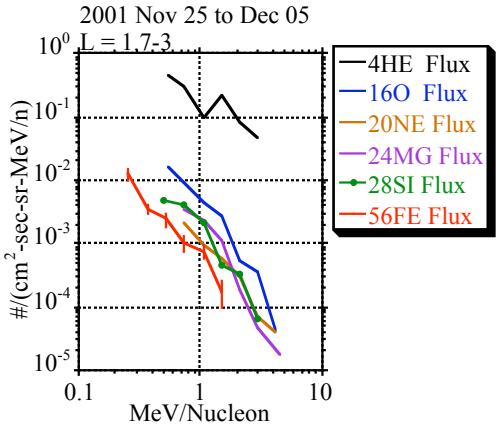
Preliminary energy spectra of new radiation belts associated with SEP events & shocks

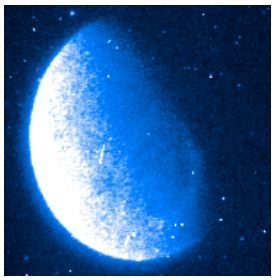




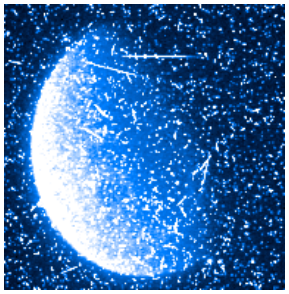




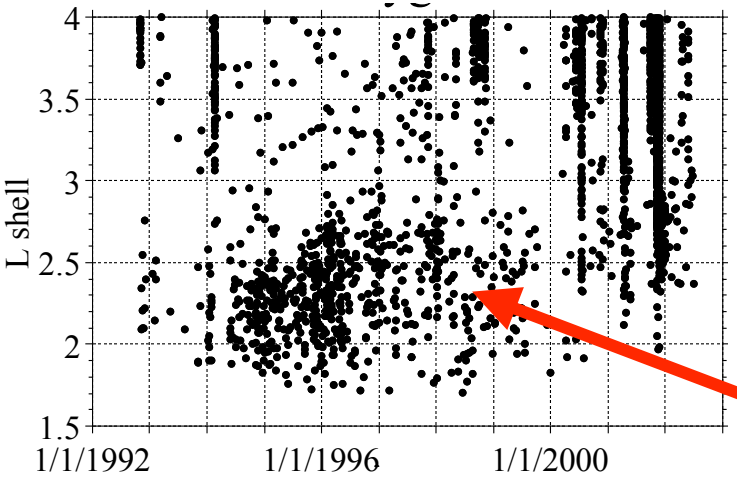




WGIII: CDAW Progress

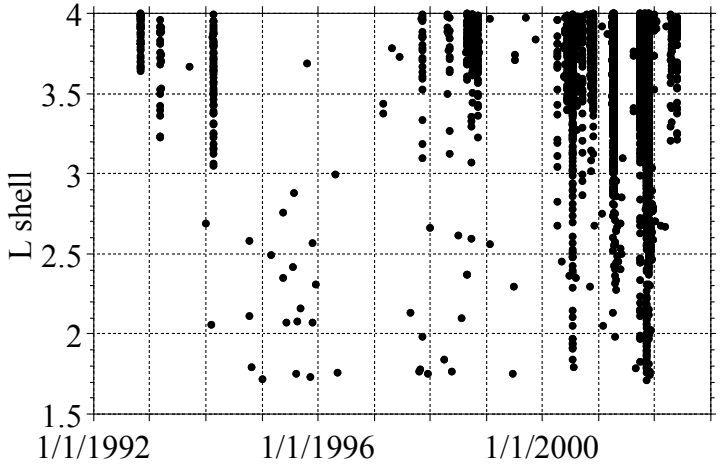


- Compare SAMPEX proton energy spectra to trapped proton models

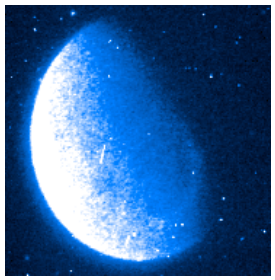


Oxygen: ~1-8 MeV/n

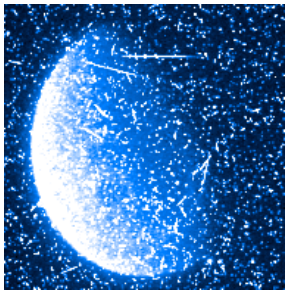
Includes trapped anomalous cosmic rays



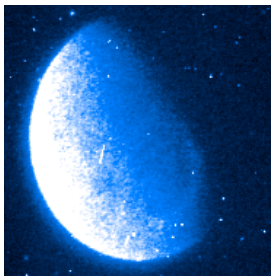
Iron: ~1-3 MeV/n



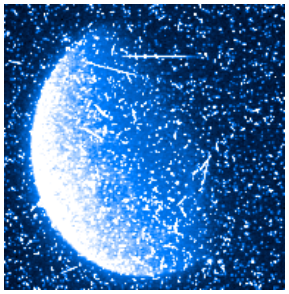
WGIII: Favored Events



	SEP date	Storm	Source spectra	IMF	trapping?	Max SW speed (1AU)
	4/4/2000	4/6/2000 ~-321	~Type B	Bz<0	p, □	~606
T3	7/14/2000	7/15/2000 ~-300	Type A		p, □, Fe	~1005
	11/08/2000	------	Type A		none	~900
T4	3/29/2001	3/31-1/2001 ~-358	other	Bz<0	p, □	~848
T5	4/10/2001	4/11-12/2001 ~-256	other		p, □, Fe	~756
	4/15/2001	------	Type B		none	
T6	9/24/2001	9/25-26/2001 ~-101	Type A	Bz varies, waves	Fe	~740
T2	10/1/2001	10/3/2001 ~-182	~Type B		nothing	~575
	11/4/2001	11/6/2001 ~-277	Type A	Bz<0, 60 nT	Si, Fe	~750
T1	11/22/2001	11/24/2001 ~-213	Type A		p, □, Fe	~1003
	5/22/2002	5/23/2002 ~105			p, □, O	

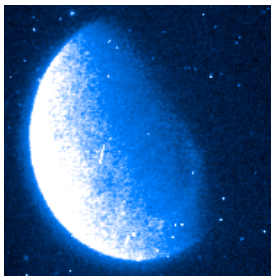


WGIII: New Collaborations

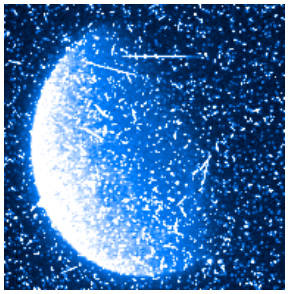


For the Geospace Impact group, every collaboration was a new collaboration:

- Dartmouth/Aerospace for several new studies on the formation of ion belts during SEP events … marrying the data with the modeling.
- Aerospace/GSFC for connections between SEP spectral characteristics at source and for trapped populations.
- GSFC/Dartmouth for appreciation of the terrestrial source of seed population ions.
- SSAI/NRL/GSFC for SEP energy deposition into the atmosphere.
- Hampton Univ/SSAI/GSFC for connection between enhanced NOx production and enhanced loss of terrestrial products to space.
- GSFC/Aerospace cooperation for validating climate models for trapped protons with SAMPEX data.
- Identified APL latitude cutoff model to support work by Xapsos/GSFC.



WGIII: CDAW Summary



As a result of these CDAW activities LWS will:

- Provide data products and theory for the improvement of space weather predict and nowcast models.
- Provide data products for technology related event/anomaly databases.
- Provide data products relevant for understanding ozone depletions as a result of SEP related odd nitrogen increases in the atmosphere.
- Make the connection between solar dynamic conditions and the formation of new ion belts at low L-shells. When are conditions right?
- Make substantial progress toward understanding the physical processes behind the formation of new ion radiation belts.